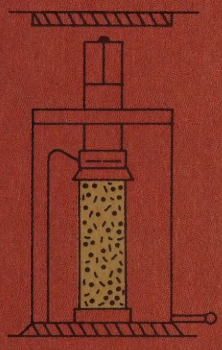
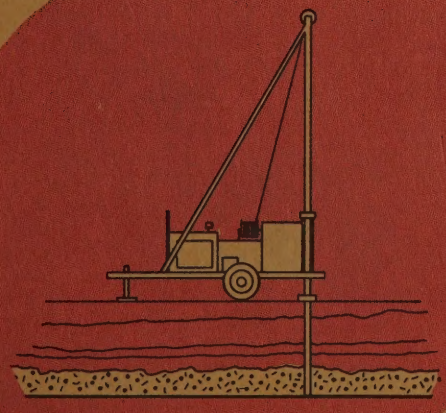
STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION

SOIL MECHANICS
BUREAU





Determination of Overlay Thickness
PIN 7145.00
I-87, Ridge Road-Canadian Border
(Portion of Section C7.1-C9)
Clinton County

February 19, 1970

SM 238a (1/69)

M E M O R A N D U M

February 19, 1970

TO: Malcolm D. Graham
Deputy Chief Engineer

FROM: Wm. P. Hofmann, Director
Bureau of Soil Mechanics

SUBJECT: Transmittal of Report
"Determination of Overlay Thickness"
PIN 7145.00
I-87 Ridge Road-Canadian Border
(Portion of Section C7.1-C9)
Clinton County

Transmitted herewith is the above report prepared at the request of Regional Director, Austin H. Emery, dated January 26, 1970.

The traffic analysis portion of the report was prepared by Keith Q. Smith of the Program Analysis Bureau. You will note that use of the "AASHO Interim Guide, Design of Flexible Pavement Structures" dated October 12, 1961 results in an empirical overlay thickness for this project of 1.02 inches. In my judgment, this thickness is neither practical nor adequate to provide a Serviceability Index of even 2.0 at the end of nine years.

I therefore recommend that the overlay consist of 2-1/2 inches of Item 51F, Asphalt Concrete - Type 1A (Mixing Method - Two Course) which is placed on Item 51TL, Asphalt Concrete, Truing and Leveling Course. A Special Note in the Proposal shall require that both courses are placed with a paver equipped with automatic controls.

It is my understanding that the Bureau of Public Roads has already approved the concept of an overlay for this section; but that the thickness of the overlay has yet to be justified. Consequently, the attached report should be transmitted to the Bureau of Public Roads as soon as possible. It is also my understanding that another condition survey of this section is not necessary.

NYSDOT
Library
50 Wolf Road, POD 34
Albany, New York 12232

Wm. P. Hofmann, Director
Bureau of Soil Mechanics

WPH/bpa
cc: G. W. McAlpin
A. H. Emery (2)

NEW YORK STATE
DEPARTMENT OF TRANSPORTATION

Inter - Office Correspondence

To: W. P. Hofmann, Director, Soils Mechanics Bureau

Date: January 26, 1970

From: Austin H. Emery, Acting Regional Director, Region 7
By: Francis R. Campbell, Regional Design Engineer

Subject: Interstate System Pavement Evaluation

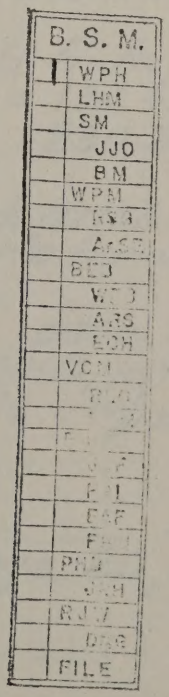
On page 17A of the "Current Road Program" for Region 7 is Project No. 7145.00, resurfacing Interstate 87, Route 502-5-4.2 Sect. 7D2, SH 58-25 in Clinton County.

In accordance with IM 21-1-67 and a letter to Reg. Transport Directors dated November 17, 1969 from J. K. Mladinov, we respectfully request a pavement design analysis on the above mentioned project.

Inasmuch as the proposed P.S.&E. date is February, 1970, your endeavor to justify this project will be greatly appreciated.

FRANCIS R. CAMPBELL
Regional Design Engineer

FRC:EDJ:emb
cc: Malcolm D. Graham
E. Hoose
D. Wilson



STATE OF NEW YORK DEPARTMENT OF TRANSPORTATION

SOIL MECHANICS BUREAU

PROJECT: PIN 7145.00, I-87 Sheet 1 of 3 Sheets
IR 502-5-4.2 Sec. 702 Prepared by: WDL Date 2/13/70
RIDGE RD. - CANADIAN BORDER Checked by: AGS Date 2-17-70

(PORTION OF SECT. C7.1-C9)

ANALYSIS OF PAVEMENT, DESIGN OF OVERLAY

(See 10C, 1/26/70 Emery to Hofmann)

A. KNOWN

1. Date of Authorization = 1958
2. FISH 58-25, Open to Traffic 1961
3. Length = 12.6 miles
4. Pavement Section (from plans):
   - 2½ in. asph. conc. Item 51S, Type 1A
   - 3" in. " " Item 45SY
   - 4 in. broken stone Item 45
   - 12 in. subbase, Item 39A

B. ASSUMPTIONS

1. Pavement reached Serviceability Index = 2.5 in 1968.
2. ADL, Travel Lane, 18^K Equiv. Single Axle Loads, 1961 to 1968 (SI = 2.5) = 151,45 *
3. ADL 18^K ESAL, 1969 to 1978 = 230.25 *

* See computations by K.G. Smith transmitted by 10C 2/10/70, Sternbach to Hofmann.

4. Coef. of Relative Strength (See page 22, AASHO, Interim Guide 10/12/61)
   - Item 51S, a_1 = 0.44
   - Item 45SY a_2 = 0.34
   - Item 45 a_2 = 0.14
   - Item 39A a_3 = 0.11

5. Regional Factor, R = 3. (See page 20, Ibid.)

SM 273 (12/67)

STATE OF NEW YORK DEPARTMENT OF TRANSPORTATION

SOIL MECHANICS BUREAU

PROJECT: PIN 7145.00 Sheet 2 of 3 Sheets

Prepared by: WPL Date 2/13/70

Checked by: AKS Date 2-17-70

C. COMPUTATIONS Traffic

1. Total 18 KESAL 1961 to 1968
8 × 365 × 151.45 = 442,234

Total 18 KESAL 1969 to 1978
10 × 365 × 230.25 = 840,413

Total 18 KESALS 1961 to 1978 1,282,647

2. Structural Number SN of Existing Pavement

Item 51S	= 2.5	× .44	=	1.10
Item 45 SY	= 3	× .34	=	1.02
45	= 4	× .14	=	.56
39A	= 12	× .11	=	1.32
		SN	=	4.00

3. Total Traffic To 20 yr. Daily Traffic

$\frac{442,234}{20 \times 365}$ = 60 18 KESAL/day

$\frac{1,282,647}{20 \times 365}$ = 175 18 KESAL/day

4. Using Chart 400-2 (AASHO Interim Guide, 10/12/61)

a. Start at 4.00, SN, Weighted Struct. No.
b. Extend line from SN = 4.0 through Regional Factor R = 3 to SN = 3.4
c Extend line from SN = 3.4 through 60 equivalent daily 18 K Single axle load applications to Soil Support Value S = 3.2

5. Using Chart 400-1 for Serviceability Index p_t = 2.0 in 20 years (1978). See letter Williams (BPR) to Crowley (BPR) 3/19/69

SM 273 (12/67)

STATE OF NEW YORK DEPARTMENT OF TRANSPORTATION

SOIL MECHANICS BUREAU

PROJECT: PIN 7145.00 Sheet 3 of 3 Sheets

Prepared by: WPR Date 2/16/70

Checked by: ARS Date 2-17-70

C5 continued

a. Start at Soil Support Value, S = 3.2
b. Extend line through 175 equivalent daily single axle load applications to SN = 3.8, thence through R = 3 to SN = 4.45.

6. Overlay Thickness

Empirical Thickness = (4.45 - 4.00) / 0.44

" " = 1.02 inches ←

[This is impractical and inadequate to provide a serviceability index of even 2.0 at the end of 9 years]

D. RECOMMENDATION

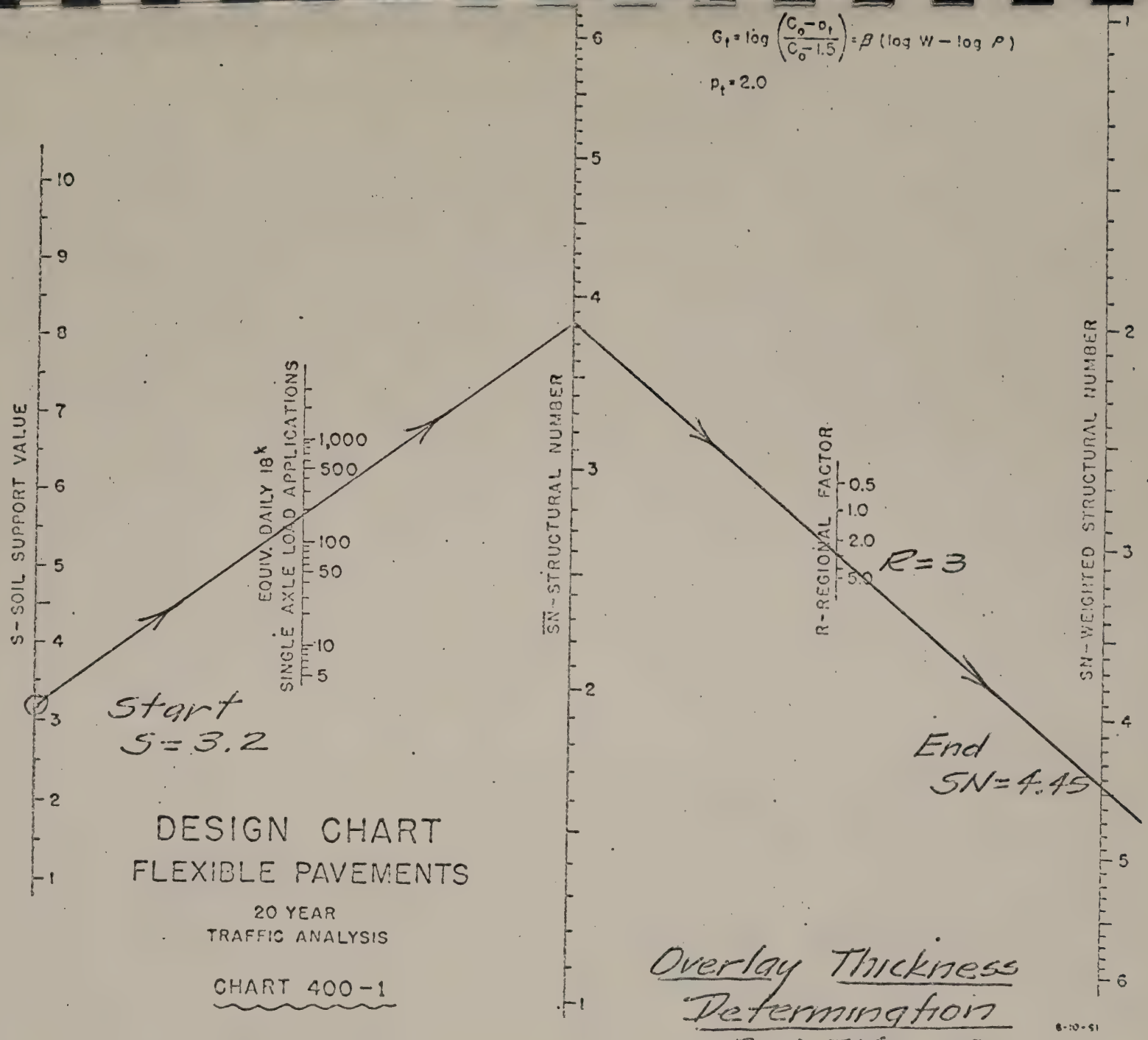
a. 2 1/2 inch A.C. over truing and levelling course to consist of:

b. 2 1/2 inches of Item 51F, Asphalt Concrete - Type 1A (Mixing Method, Two Course)
over
Item 51Th, Asphalt Concrete Truing & Levelling Course

c. Special Note in Proposal should require that both courses are placed with paver equipped with automatic controls.

End

SA 273 (12/67)

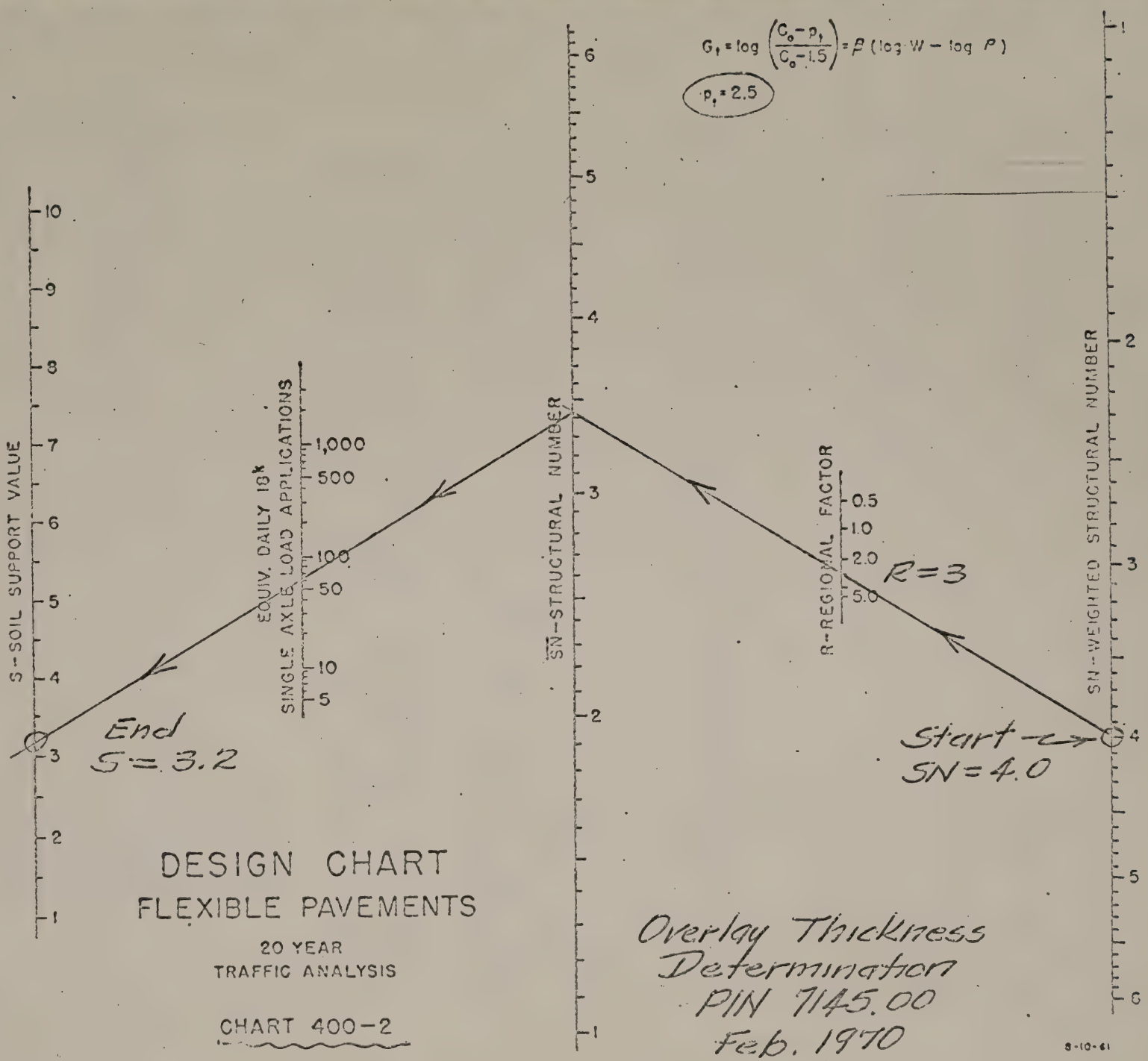


DESIGN CHART
FLEXIBLE PAVEMENTS

20 YEAR
TRAFFIC ANALYSIS

CHART 400-1

Overlay Thickness
Determination
PIN 7145.00
Feb. 1970
wpk



DESIGN CHART
FLEXIBLE PAVEMENTS

20 YEAR
TRAFFIC ANALYSIS

CHART 400-2

Overlay Thickness
Determination
PIN 7145.00
Feb. 1970
wpl

NEW YORK STATE
DEPARTMENT OF TRANSPORTATION

Inter - Office Correspondence

To: William P. Hofmann, Director
Soil Mechanics Bureau

Date: Feb. 10, 1970

From: J. Sternbach

Subject: Project 7145.00
I-87 (Portion of Section C7.1-C9)
Clinton County (Region 7)

Pavement Analysis

To assist you in the preparation of the pavement design analysis for the subject project, we are enclosing two copies of the necessary traffic analysis.

In summary our analysis furnishes

1) the equivalent 18,000# axle loads estimated to have occurred on one lane of the project pavement from the time of its opening to traffic in 1961 to the time the serviceability index had been reduced to 2.5 (assumed to be the year 1968). A structural number of 4.3 was used for this 8-year period. The ADL for this 8-year period is estimated to be 151.45.

2) the equivalent 18,000# axle loads estimated to occur from 1969 through the pavement design year of 1978. A structural number of 5.0 and a serviceability index of 2.0 was used for this period. The ADL for this 10-year period is estimated to be 230.25.

J. STERNBACH, Director
Program Analysis Bureau

JS/KQS/ncs

Enclosures 2

cc: Mr. M. Graham
Mr. A. Tweedie

B. S. M.
WPH
LHM
SM
JJO
BM
WPM
RSG
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BED
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2-4-70
Compiled by K. Smith

TRAFFIC DATA FOR
PAVEMENT JUSTIFICATION

I-87 2.6 Mile Portion of C7.1-C9

Pavement Design Year	1975	Data From
Pavement Authorization	1958	Table AW-2
Pavement Open to Traffic	1961	

With reference to BPR CM dated May 9, 1967:

The applicable design periods and design years for the pavement structure -

(b) Projects constructed with FAI funds for which pavement construction was authorized prior to October 24, 1963: The design traffic analysis is to be 20 years after the date of authorization of the initial pavement construction project.

Therefore, the design year for pavement will be 1978.

Traffic data needed. (Refer to April 7, 1969 memo from G. M. Williams).

a/ the total equivalent 18-kip single axle load applications that will have passed over the traffic lane of the pavement structure during the period of time from its initial opening to traffic (1961 in this case) to the date when the serviceability index (p_t) will be 2.5 and the overlay is to be placed.

(b) the total equivalent 18-kip single axle load applications that will have passed over the traffic lane of the pavement structure during the period of time from its initial opening to traffic (1961 in this case) to the time that the pavement on which an overlay has been placed will have a serviceability index (p_t) of 2.0, which traffic and time period are represented in design at least by a 20-year design period.

Refer to pages A53 to A66 of the 1970 Interstate Cost Estimate Manual.

Data from Table W-1 for Station #782 for Selected Years

Vehicle Type	1964	% Tot.	1965	% Tot.	1966	% Tot.	1968	% Tot.
Pass. Cars	7602	94.18	3916	87.96	4166	85.25	4173	85.16
Buses	16	0.20	23	0.52	44	0.90	53	1.08
Panels & Pickups	104	1.29	85	1.91	158	3.23	123	2.51
Other 4-tire trucks	16	0.20	12	0.27	5	0.10	11	0.23
2-axle,6-tire trucks	72	0.89	87	1.95	160	3.28	126	2.57
3-axle trucks	5	0.06	13	0.29	23	0.47	13	0.27
3-axle semi-trailers	25	0.31	37	0.83	28	0.57	27	0.55
4- " "	201	2.49	188	4.22	144	2.95	144	2.94
5- " "	30	0.37	90	2.02	159	3.25	228	4.65
4-axle full trailers	1	0.01	1	0.02	0	0	2	0.04
Tot. Vehs. Counted	8072	100.00	4452	100.00	4887	100.00	4900	100.00

Note: 1964 count made on Canadian National Holiday.
1967 count not included - because of Expo 67.

Conclusion:

Use year 1968 as the representative year to determine percent of trucks.

LANE DISTRIBUTION: Refer to page 106 - Highway Capacity Manual "On Upgrades . . . most of the trucks stay in lane 1, ..."

Assumption: 95% of the lighter trucks use Lane 1. 100% of the heavier trucks use Lane 1. Since passenger cars have little effect on Pavement Design assume 60% in Lane 2, 40% in Lane 1.

TRAFFIC DATA ON I-87 FROM VARIOUS INTERSTATE COST ESTIMATES

	Cost Estimate Year	Projection Year	Traffic
	1965	1962	3,608
	1968	1965	4,009
	1970	1967	4,820
	1970	1975	8,700
	1970	1990	13,000
Year open to traffic		1961	3,474
Design Year		1978	9,560
Mean AADT			6,517
Directional Mean AADT			3,259
Year that P = 2.5		1968	5,305
Mean AADT		1961-1968	4,390
Directional Mean AADT			2,195
Mean AADT		1969-1978	7,433
Directional Mean AADT			3,717

Received call from W. Hofmann and he furnished the following data:

1. He would like us to estimate the equivalent 18,000# axle loads that have been over the pavement from 1961 (date of initial service) through 1968 (date of physical inspection and assumed P of 2.5) SN is 4.3 for this period.

2. Calculate the equivalent 18,000# axle loads that will go over the pavement from 1969 through 1978 (design year). Assume P of 2.0 and SN of 5 for this 10-year period.

IS

SECTION OF I-87/FROM ROUTE 11 SOUTH 1.3 MILES

Vehicle Type	% from Counts or fore-casts	Distrib. of ½ ADT 1961-1968	% Vehs. in Lane 1	Distrib. of Vehs. in Lane 1	18 Kip Axle Equivs. P = 2.5 SN = 5 (from W-4) Rate/1000 (1966 Data)	Convert to 18 Kip Axle Equivs. P = 2.5 SN = 4.3 (Rate/1000)	ADL
Passenger Cars	85.16	1869	40	748	0.8 1)	0.9	0.67
Buses	1.08	24	95	22	257.0 1)	276.0	6.07
Panels & Pickups	2.51	55	95	52	2.3	2.7	0.14
Other 4-Tire Trucks	0.23	5	95	5	6.3	7.3	0.04
2-Axle, 6-Tire Trucks	2.57	56	95	53	182.0	198.0	10.50
3-Axle Trucks	0.27	6	95	6	704.4	717.0	4.30
3-Axle Semi-Trailers	0.55	12	100	12	520.8	548.0	6.58
4-Axle Semi-Trailers	2.94	65	100	65	813.2	835.0	54.28
5-Axle Semi-Trailers	4.65	102	100	102	641.0	667.0	68.04
4-Axle Full Trailers	0.04	1	100	1	813.2 2)	835.0	0.83
TOTAL	100.00	2195		1066			151.45

Total 8-year 18,000# axle loadings = 151.45 x 365 x 8 = 442,234
Years 1961 through 1968

1) from pg. A-63 1970 Estimate Manual

2) estimated

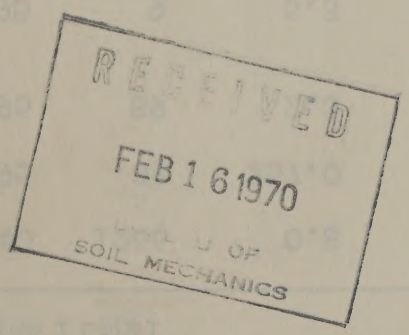
Prepared By K. Fuller
2/9/70

SECTION OF I-87 IS FROM ROUTE 11 SOUTH 1.3 MILES

Vehicle Type	% from Counts or forecasts	Distrib. of ½ ADT 1969-1978	% Vehs. in Lane 1	Distrib. of Vehs. in Lane 1	18 Kip Axle Equiv. P = 2.5 SN = 5 (From W-4) Rate/1000	Convert to 18 Kip Axle Equivs. @ P = 2.0 SN = 5	ADL
Passenger Cars	85.16	3164	40	1266	0.8	0.7	0.88
Buses	1.08	40	95	38	257.0	239.0	9.08
Panels & Pickups	2.51	93	95	89	2.3	2.0	0.18
Other 4-Tire Trucks	0.23	9	95	9	6.3	5.6	0.05
2-Axle-6-Tire Trucks	2.57	96	95	90	182.0	114.0	10.26
3-Axle Trucks	0.27	10	95	10	704.4	674.0	6.74
3-Axle Semi-Trailers	0.55	21	100	21	520.8	500.0	10.50
4-Axle Semi-Trailers	2.94	109	100	109	813.2	784.0	85.46
5-Axle Semi-Trailers	4.65	173	100	173	641.0	610.0	105.53
4-Axle Full Trailers	0.04	2	100	2	813.2	784.0	1.57
TOTAL	100.00	3717					230.25

Total 10-year (1969-1978) 18,000# Axle Loadings = 230.25 x 365 x 10 = 840,413

Prepared By K. Smith
2/4/70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